

WHAT IS CLAIMED IS:

1. A guidewire comprising:

an elongate core member having a proximal section and a distal section with a longitudinal portion having a curvilinear taper which tapers distally to a reduced transverse dimension; and

a polymer layer disposed about at least a portion of the distal section.

2. The guidewire of claim 1 wherein the polymer layer has a substantially constant outer diameter.

3. The guidewire of claim 1 wherein the longitudinal portion has a length of about 5 to about 25 cm.

4. The guidewire of claim 1 wherein the distal end of the guidewire tapers distally to a reduced outside diameter.

5. The guidewire of claim 1 further comprising a helical coil disposed about the distal section of the elongate core member.

6. The guidewire of claim 1 comprising a first polymer layer disposed about at least a portion of the distal section of the elongate core member and a second polymer layer disposed about at least a portion of the first polymer layer.

7. The guidewire of claim 6 wherein the second polymer layer has a substantially constant outer diameter.

8. The guidewire of claim 5 wherein at least a portion of the helical coil is stacked.

9. The guidewire of claim 1 wherein the polymer layer is comprised of a material selected from the group consisting of polyurethane, polyamide, copolymers of polyurethane and copolymers of polyamide.

10. The guidewire of claim 6 wherein the first polymer layer is comprised of a U.V. cured polyurethane and the second polymer layer is comprised of a thermally co-extruded polymer.

11. The guidewire of claim 5 wherein the helical coil is comprised of a radiopaque material.

12. The guidewire of claim 11 wherein the radiopaque material is selected from the group consisting of gold, platinum, platinum-iridium, tantalum and tungsten.

13. A guidewire comprising:
an elongated core member having a proximal section and a distal section with a longitudinal portion having a substantially linear change in stiffness in an axial direction; and

a polymer layer disposed about at least a portion of the distal section.

14. The guidewire of claim 13 wherein the longitudinal portion has a continuously changing taper angle producing a curvilinear profile that is

configured to produce the substantially linear change in stiffness in an axial direction.

15. The guidewire of claim 13 wherein the longitudinal portion has a plurality of tapered segments with each segment having a substantially constant taper angle configured to produce the substantially linear change
5 in stiffness in an axial direction.

16. The guidewire of claim 13 further comprising a helical coil disposed about the distal section of the elongate core member.

17. The guidewire of claim 16 wherein the helical coil is comprised
10 of a radiopaque material.

18. The guidewire of claim 17 wherein the helical coil is comprised of a material selected from the group consisting of gold, platinum, platinum-iridium, tantalum and tungsten.

19. The guidewire of claim 13 comprising a first polymer layer
15 disposed about at least a portion of the distal section of the elongate core member and a second polymer layer disposed about the first polymer layer.

20. The guidewire of claim 15 wherein the longitudinal portion comprises about 5 to about 20 tapered segments.

20 21. The guidewire of claim 13 wherein the longitudinal portion is about 5 to about 25 cm in length.

22. The guidewire of claim 13 wherein the longitudinal portion substantially follows the formula

$$D_L = \left[\frac{64CL}{E\pi} + D_0^4 \right]^{\frac{1}{4}}$$

where D_L is the diameter of the elongate core member at length L from a position of starting diameter D_0 , E is the modulus of elasticity of the core member material, and C is a constant that depends on the boundary conditions of the longitudinal portion.

23. The guidewire of claim 13 wherein the polymer layer is selected from a group consisting of polyurethanes, polyamide, copolymers of polyurethane and copolymers of polyamide.

24. A guidewire comprising:

an elongated core member having a proximal section and a distal section with a plurality of radiopaque markers disposed thereon at regular intervals in axial position and a longitudinal portion which tapers distally to a reduced transverse dimension;

a flexible body member disposed about the distal section of the elongate core member; and

a polymer layer disposed about at least a portion of the distal section of the elongate core member and the flexible body member.

25. The guidewire of claim 24 wherein the polymer layer is selected from a group consisting of polyurethanes, polyamide, copolymers of polyurethane and copolymers of polyamide.

26. The guidewire of claim 24 wherein the polymer layer has a substantially constant outer diameter.

27. The guidewire of claim 24 wherein the longitudinal portion has a substantially linear change in stiffness with respect to a change in axial position.

28. The guidewire of claim 24 wherein the longitudinal portion has a length of about 5 to about 25 cm.

29. The guidewire of claim 24 wherein the longitudinal portion has a curvilinear taper over a length thereof.

30. The guidewire of claim 24 wherein the radiopaque markers are made of a radiopaque metal secured to the distal section of the elongate core member.

31. The guidewire of claim 30 wherein the radiopaque metal for the radiopaque markers is selected from the group consisting of gold, platinum, platinum-iridium, tantalum and tungsten.

32. The guidewire of claim 24 wherein the markers are made of a radiopaque matrix applied to the distal section of the elongate core member.

33. The guidewire of claim 32 wherein the radiopaque matrix comprises a radiolucent polymer doped with a radiopaque material.

34. The guidewire of claim 32 wherein the radiopaque matrix comprises an ink doped with a radiopaque material.

5 35. The guidewire of claim 32 wherein the radiopaque matrix comprises an adhesive doped with a radiopaque material.

36. The guidewire of claim 33 wherein the radiolucent polymer comprises polyurethane.

10 37. The guidewire of claim 33 wherein the radiopaque material comprises tungsten powder.

38. The guidewire of claim 49 wherein the radiopaque material comprises a material selected from the group consisting of gold, platinum, tungsten platinum-iridium, tantalum, barium compounds including barium sulfate and bismuth compounds.

15 39. A guidewire comprising:

an elongate core member having a proximal section and a distal section with a longitudinal portion which tapers distally to a reduced transverse dimension; and

20 a radiopaque helical coil disposed about and secured to the distal section of the elongate core member and having a plurality of spaced portions separated by adjacent non-spaced portions with the spaced

portions having less radiopacity than adjacent non-spaced portions and being spaced at regular predetermined longitudinal positions.

40. The guidewire of claim 39 wherein at least one spaced portion of the helical coil is filled with a radiolucent material.

5 41. The guidewire of claim 39 wherein at least one of the non-spaced portions of the helical coil has a stacked configuration.

42. The guidewire of claim 39 wherein the longitudinal portion comprises a curvilinear taper.

10 43. The guidewire of claim 39 wherein the longitudinal portion has a length of about 5 to about 25 cm.

44. The guidewire of claim 39 wherein the longitudinal portion is configured to have a linear change in stiffness in an axial direction.

15 45. The guidewire of claim 39 further comprising a polymer layer disposed about at least a portion of the distal section of the elongate core member.

46. The guidewire of claim 45 wherein the polymer layer is selected from a group consisting of polyurethanes, polyamides, copolymers of polyurethane and copolymers of polyamide.

20 47. The guidewire of claim 40 wherein the radiolucent material is selected from the group consisting of radiolucent solder, epoxy, polymer and adhesive.

48. The guidewire of claim 39 wherein the radiopaque helical coil is comprised of a radiopaque metal.

49. A guidewire comprising:

an elongated core member having a proximal section and a distal
5 section with a longitudinal portion which tapers distally to a reduced transverse dimension; and

a radiolucent helical coil disposed about the distal section of the elongate core member having a plurality of sites at regular intervals with respect to axial position with a radiopaque material disposed on the helical
10 coil and separated by radiolucent portions of the helical coil.

50. The guidewire of claim 49 wherein radiopaque material of at least one of the sites with a radiopaque material disposed on the helical coil comprises a radiopaque solder.

51. The guidewire of claim 49 wherein the radiolucent helical coil
15 further comprises at least one longitudinally spaced portion and at least one longitudinally non-spaced portion and the radiopaque material is disposed in the longitudinally spaced portion.

52. The guidewire of claim 49 wherein the radiopaque material of at least one of the sites with a radiopaque material disposed on the helical
20 coil comprises a material selected from the group consisting of a radiopaque polymer, a radiolucent polymer doped with a radiopaque

material, an ink doped with a radiopaque material, an adhesive doped with a radiopaque material, a paint doped with a radiopaque material and an epoxy doped with a radiopaque material.

53. The guidewire of claim 51 wherein at least one of the non-spaced portions of the helical coil has a stacked configuration.

54. The guidewire of claim 49 wherein the longitudinal portion comprises a curvilinear taper.

55. The guidewire of claim 49 wherein the longitudinal portion has a length of about 5 to about 25 cm.

56. The guidewire of claim 49 wherein the longitudinal portion comprises a linear change in stiffness in an axial direction.

57. The guidewire of claim 49 further comprising a polymer layer disposed about at least a portion of the distal section of the elongate core member.

58. The guidewire of claim 57 wherein the polymer layer is selected from a group consisting of polyurethanes, polyamide, copolymers of polyurethane and copolymers of polyamide.

59. A guidewire comprising:

an elongate core member having a proximal section and a distal section with a longitudinal portion which tapers distally to a reduced transverse dimension; and

a tubular polymer member disposed about the distal section of the elongate core member having a plurality of longitudinal segments with at least one of the longitudinal segments being radiopaque and at least one of the segments being radiolucent.

5 60. The guidewire of claim 59 wherein the longitudinal portion has a curvilinear taper.

61. The guidewire of claim 59 wherein the longitudinal portion has a length of about 10 to about 25 cm.

10 62. The guidewire of claim 59 wherein the a longitudinal portion is configured to have a linear change in stiffness in an axial direction.

63. The guidewire of claim 59 further comprising a polymer layer disposed about the distal section of the elongate core member.

15 64. The guidewire of claim 63 wherein the polymer layer is selected from a group consisting of polyurethanes, polyamide, copolymers of polyurethane and copolymers of polyamide.

65. A guidewire comprising:

an elongate core member having a proximal section and a distal section with a longitudinal portion which tapers distally to a reduced transverse dimension; and

20 a flexible body disposed about the distal section of the core member comprising a polymer layer disposed about a radiopaque layer.

66. The guidewire of claim 65 wherein the flexible body disposed about the distal section of the core member comprises a first polymer layer disposed about the distal section, a radiopaque layer disposed about the first polymer layer and a second polymer layer disposed about the radiopaque layer.

67. The guidewire of claim 65 wherein said radiopaque layer is continuous in an axial direction.

68. The guidewire of claim 67 wherein the radiopaque layer is shorter in an axial direction than the flexible body.

69. The guidewire of claim 65 wherein the radiopaque layer is intermittent in an axial direction.

70. The guidewire of claim 65 wherein the radiopaque layer is comprised of a radiopaque helical ribbon coil in an axial direction.

71. The guidewire of claim 70 wherein the radiopaque helical ribbon coil material is about 0.0005 to about 0.0040 inch in thickness.

72. The guidewire of claim 70 wherein the radiopaque helical ribbon coil material is about 0.5 to 2 mm in width and the turns of the radiopaque helical ribbon coil are about 1 to about 15 mm apart.

73. The guidewire of claim 65 wherein the polymer layer is comprised of a material selected from a group consisting of polyurethanes, polyamide, copolymers of polyurethane and copolymers of polyamide.

74. The guidewire of claim 65 wherein the radiopaque layer is comprised of a material selected from a group consisting of platinum, gold, iridium, palladium, tantalum, tungsten, and radiopaque alloys thereof.

5 75. The guidewire of claim 65 wherein the radiopaque layer is non-metallic.

76. The guidewire of claim 65 wherein the radiopaque layer comprises a polymer doped with a radiopaque material.

77. The guidewire of claim 65 wherein the polymer layer is about 0.0005 inch to about 0.0060 inch in thickness.

10 78. The guidewire of claim 77 wherein the polymer layer is about 0.0010 inch to about 0.0030 inch in thickness.

79. The guidewire of claim 65 wherein the radiopaque layer is about 0.0005 inch to about 0.0040 inch in thickness.

15 80. The guidewire of claim 79 wherein the radiopaque layer is about 0.0015 inch to about 0.0025 inch in thickness.

81. The guidewire of claim 69 wherein the intermittent radiopaque layer is comprised of radiopaque bands spaced apart a predetermined axial distance.

20 82. The guidewire of claim 81 wherein the radiopaque bands are spaced from about 0.2 to about 2 cm apart in an axial direction.

83. The guidewire of claim 81 wherein the radiopaque bands are spaced about 0.8 to about 1.2 cm apart in an axial direction.

84. The guidewire of claim 81 wherein the radiopaque bands are about 0.5 to about 5 mm in width.

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85. The guidewire of claim 81 wherein the bands are about 1 to 2 mm in width.